

Figure 1A

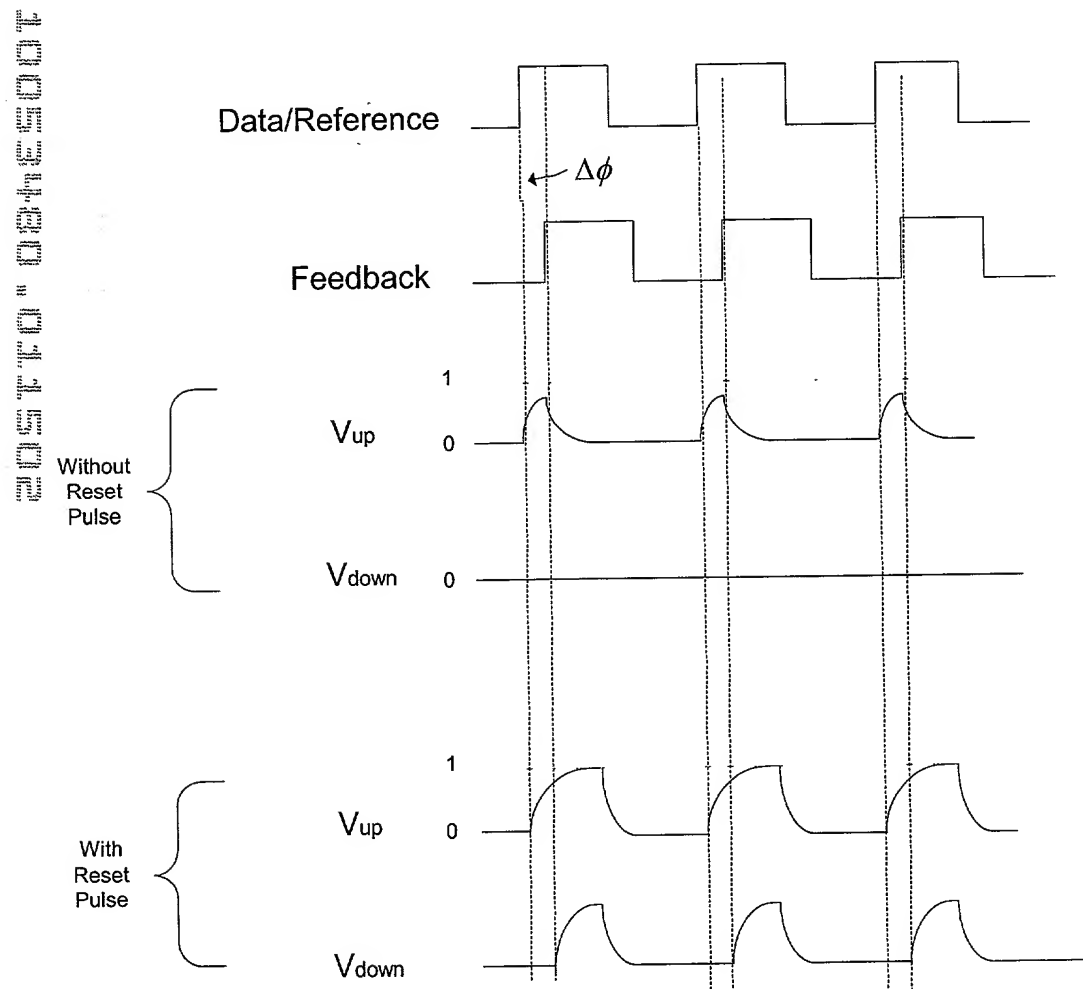


Figure 1B

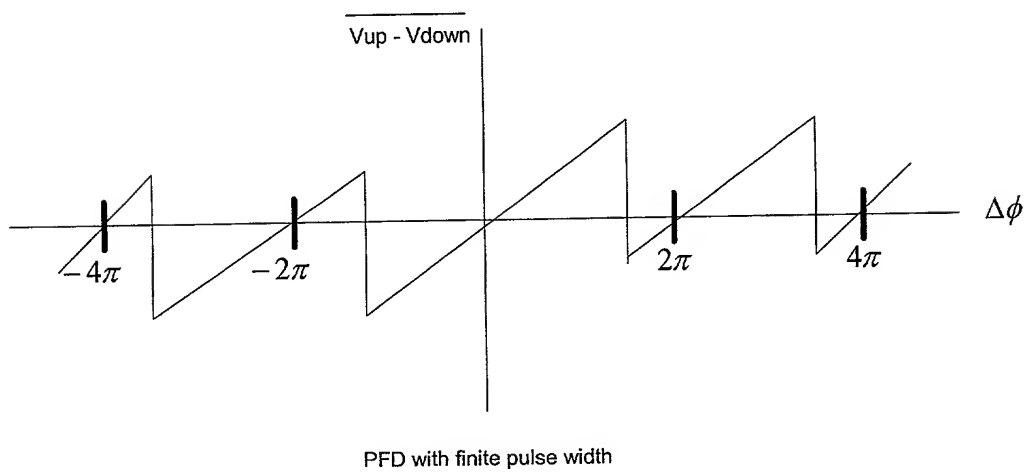
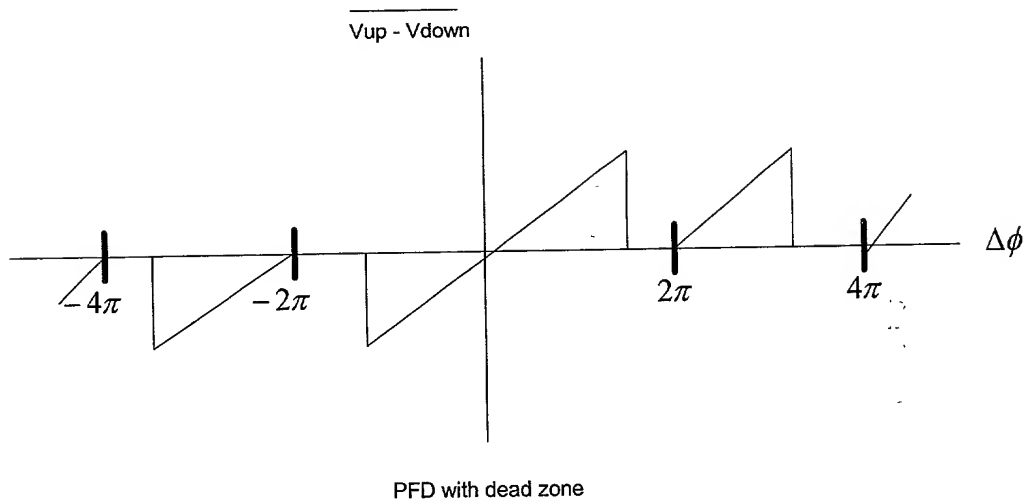
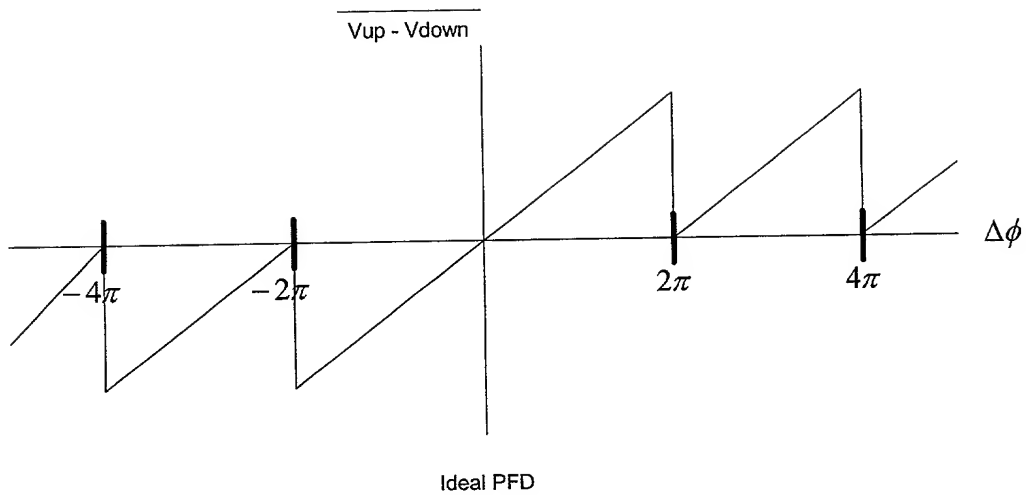


Figure 1C

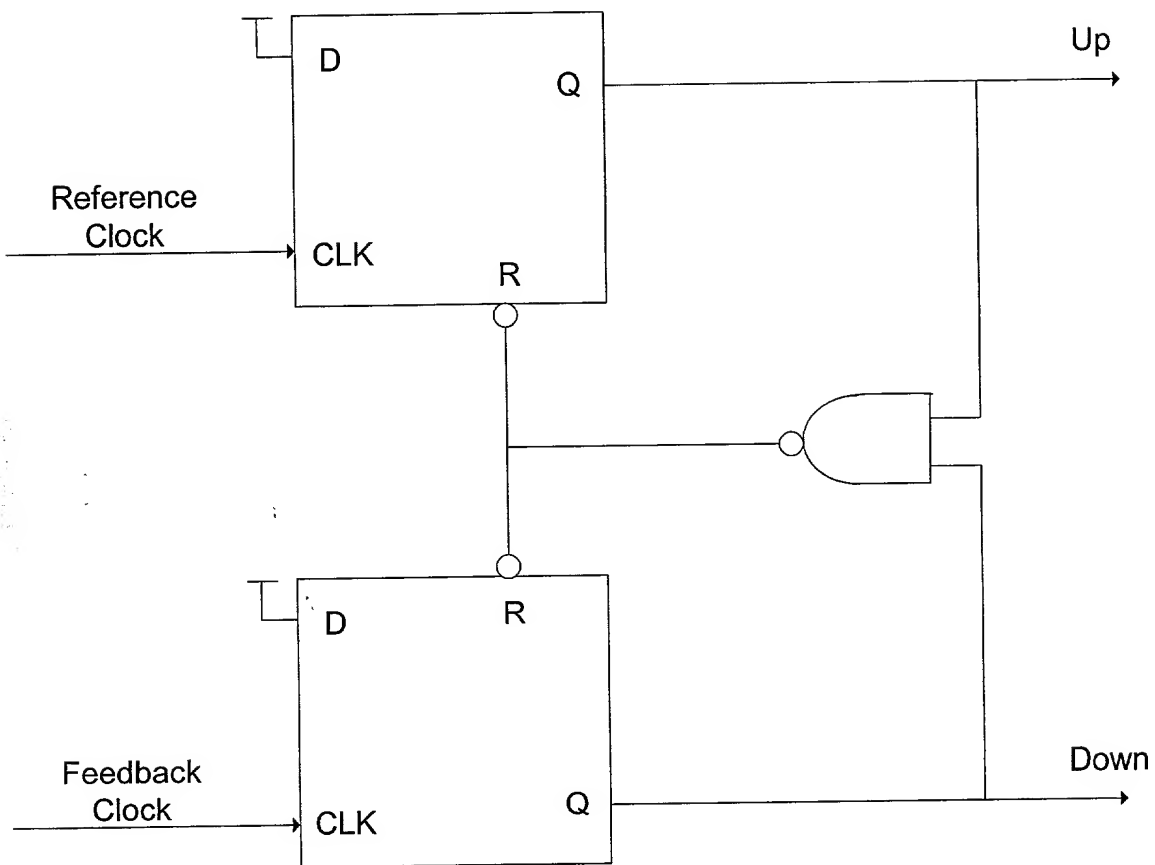


Figure 1D

The diagram illustrates a 1.5V CMOS bandgap reference circuit. It is divided into three main functional blocks: **Replica Bias**, **Feedback network**, and **Charge Pump**.

- Replica Bias:** This section on the left contains two identical PMOS and NMOS transistor pairs. The PMOS gates are connected to a common bias node, and the NMOS gates are connected to another common bias node. The NMOS sources are grounded, and the PMOS sources are connected to a common supply rail.
- Feedback network:** This central section consists of two NMOS transistors whose gates are connected to the bias nodes of the replica bias section. Their sources are grounded, and their drains are connected to the gates of the PMOS transistors in the replica bias section. Two current sources, represented by circles with downward arrows, are connected between the supply rail and the drains of these NMOS transistors.
- Charge Pump:** On the right, a charge pump circuit is used to generate a 1.5V supply rail. It features a PMOS network with two branches: one connected to V_{up} and another to $\overline{V_{up}}$. The NMOS network also has two branches: one connected to V_{down} and another to ground. A central inverter symbol indicates the internal switching mechanism of the pump.

Figure 1E

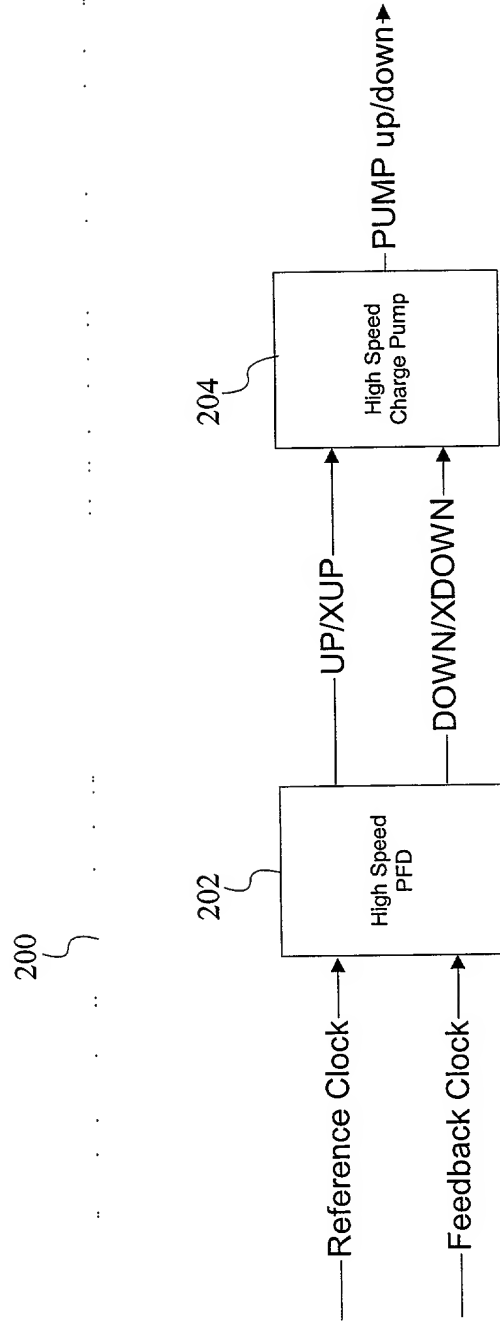


Figure 2

FIG. 3

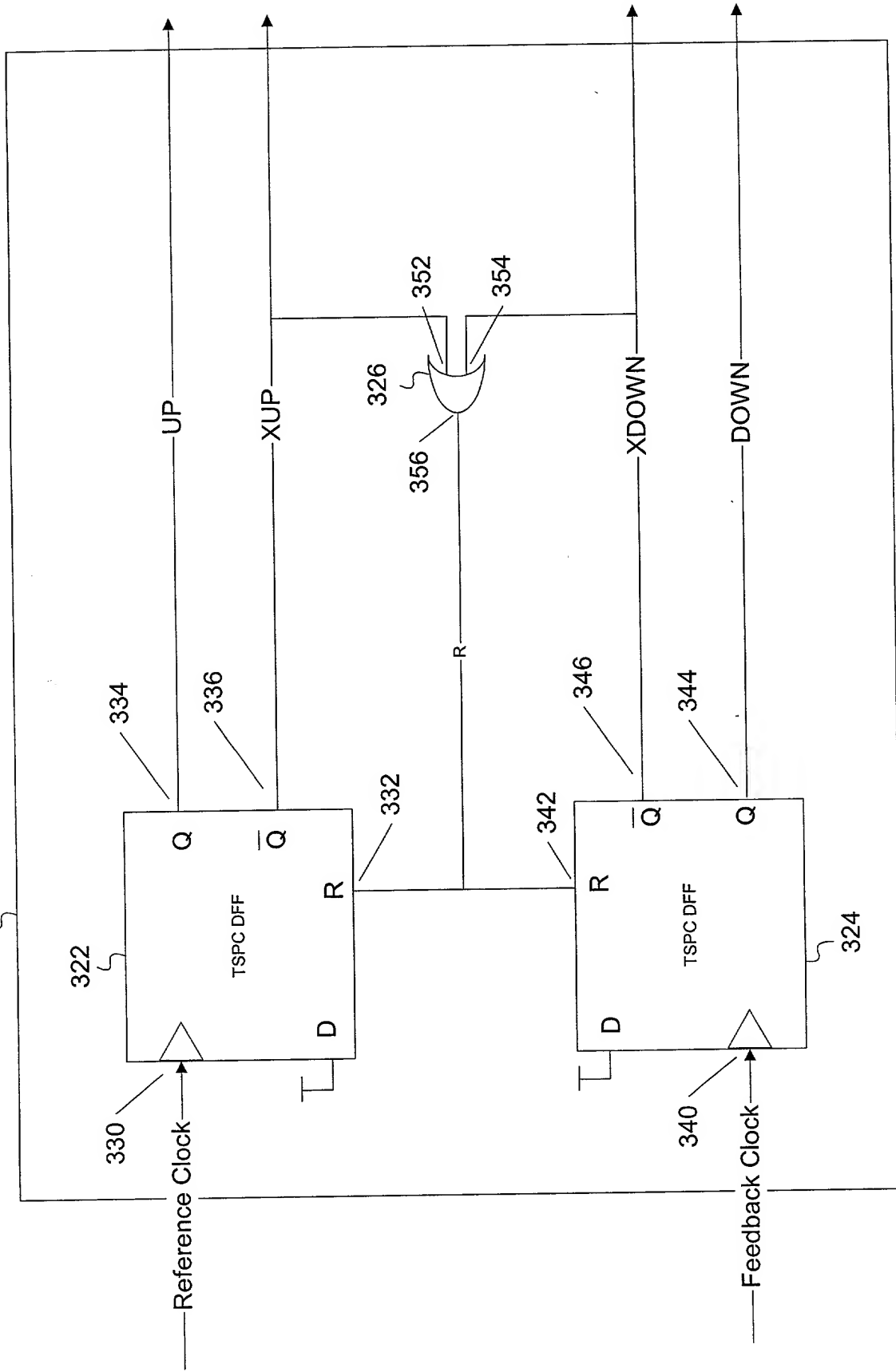


Figure 3

400

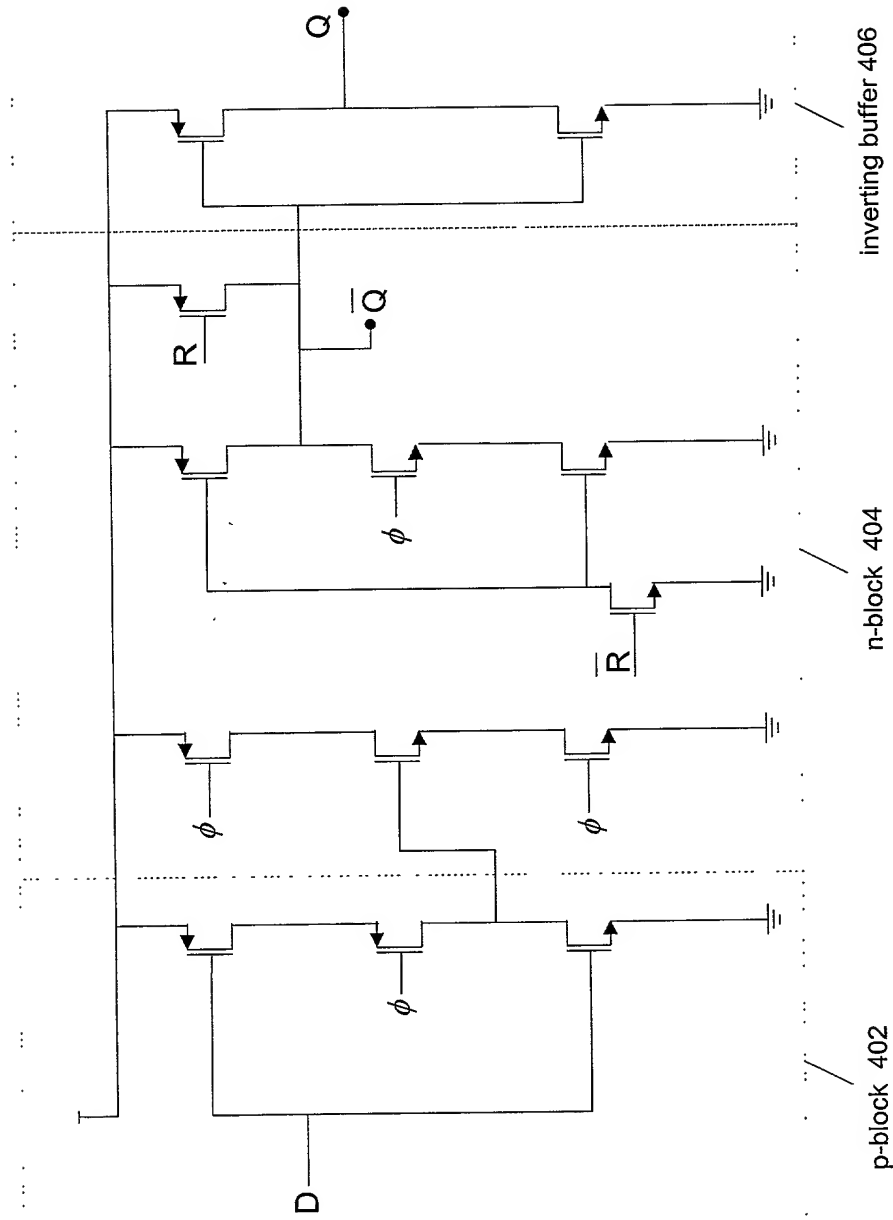


Figure 4

500

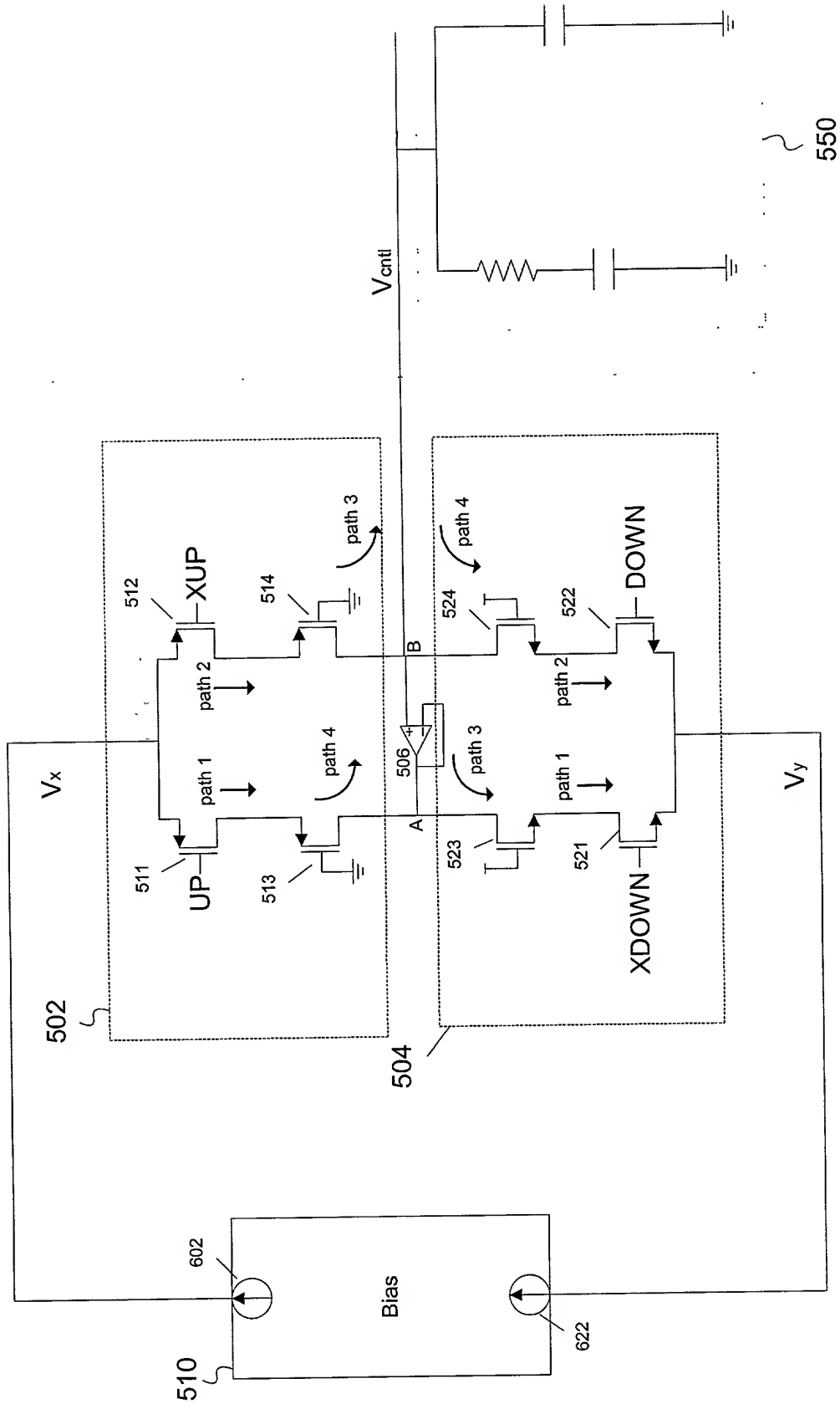
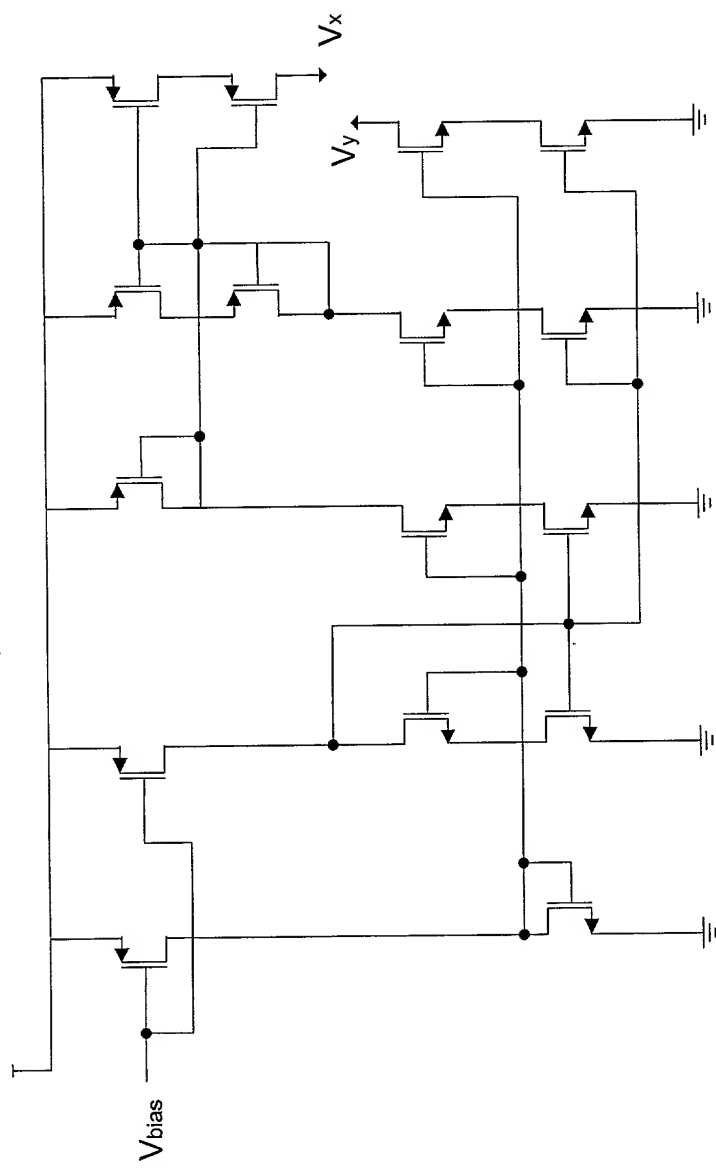


Figure 5

600



R

Figure 6

700

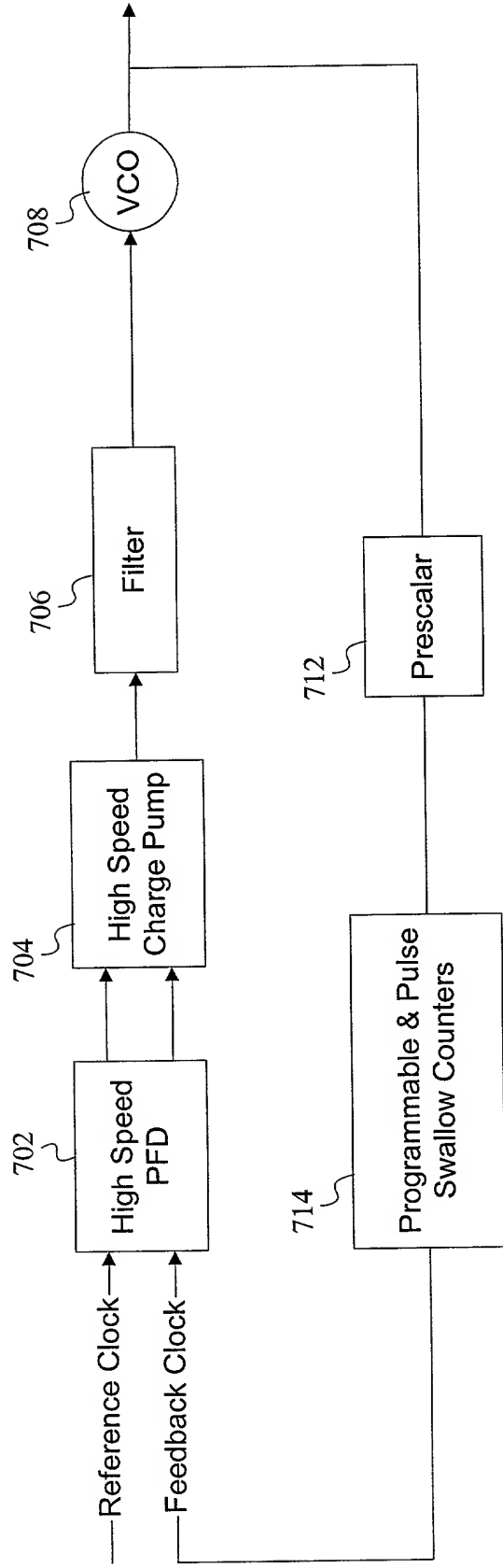


Figure 7